

PATENT

Applicant: Rahman

Serial No.: 10/615,081

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Title: Folded Monopole Antenna
For Implanted Medical Device

Group Art Unit: 2828

Examiner: Wimer

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
P.O. Box 1450
Arlington, VA 22313-1450

Mail Stop Appeal Brief - Patents

APPEAL BRIEF

I. REAL PARTY IN INTEREST

The real party in interest in the present appeal is Advanced Bionics Corporation, the assignee of the present application. Advanced Bionics Corporation is a wholly owned subsidiary of Boston Scientific Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in the present appeal.

III. STATUS OF CLAIMS

Applicant hereby appeals the rejection of pending claims 1-12, 22-30 and 32-38. No claims have been allowed. Claim 13-21 and 31 have been canceled.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. § 41.43 is being filed concurrently herewith. No other amendments were filed subsequent to the final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Independent Claim 1

Independent claim 1 is directed to an RF telemetry antenna system. Referring to Figures 1 and 5, which are reproduced below, one example of the claimed system comprises “an implantable medical device housing including a conductive, metal housing portion [20] defining an internal volume and a dielectric housing portion [30] defining an internal volume,” “a self-resonating, monopole RF antenna [60] contained within the internal volume defined by said dielectric portion [30] of said medical device housing, said monopole antenna having a free end [65] and connection end [75]” and “an internal transmitter/receiver circuit [69] having a ground reference located within the metal housing portion [20] that is connected to the metal housing portion such that the metal housing portion acts as a ground plane.” [Spec. at pars. 0037, 0038 and 0042.] Claim 1 also indicates that “the monopole RF antenna [60] has an elongate form which is folded at least once and conformed inside the internal volume defined by the dielectric housing portion [30].” [Spec. at par. 0035.] Claim 1 further indicates that “the connection end [75] of the antenna [60] is connected to the internal transmitter/receiver circuit [69].” [Spec. at par. 0042.]

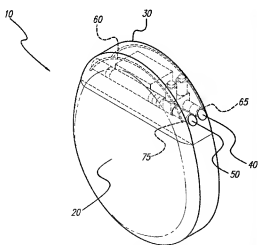


Figure 1 of the Present Application

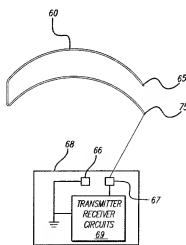


Figure 5 of the Present Application

B. Independent Claim 22

Independent claim 22 is directed to “[a]n implantable medical device.” Referring to Figures 1 and 5, which are reproduced above, one example of the claimed device comprises “a housing having a dielectric portion [30] defining an internal volume and a metal portion [20] defining an internal volume” and “a transmitter/receiver circuit [69] located within the housing.” [Spec. at pars. 0037 and 0042.] The illustrated example of the claimed device also includes “an elongate monopole RF antenna [60], with a connection end [75], a free end [65] and at least one fold between the connection end and the free end, operably connected to the transmitter/receiver circuit [69] and positioned entirely within the dielectric portion [30] internal volume such that the free end is closer to the connection end than the at least one fold.” [Spec. at pars. 0038, 0041 and 0042.]

C. Independent Claim 24

Independent claim 24 is directed to “[a]n implantable medical device.” Referring to Figures 1 and 5, which are reproduced above, one example of the claimed device comprises “a housing having a dielectric portion [30], defining an internal volume and including a curved region, and a metal portion [20] defining an internal volume” and “a transmitter/receiver circuit [69] located within the housing.” [Spec. at pars. 0037 and 0042.] The illustrated example of the claimed device also includes “an elongate monopole RF antenna [60], with at least one fold and first and second arcuate portions that extend along the curved region in first and second planes that are substantially parallel to one another, operably connected to the transmitter/receiver circuit and positioned entirely within the dielectric portion internal volume.” [Spec. at pars. 0038, 0041 and 0042.]

D. Independent Claim 33

Independent claim 33 is directed to “[a]n implantable medical device.” Referring to Figures 1 and 5, which are reproduced above, one example of the claimed device comprises “a housing having a dielectric portion [30] defining an internal volume and a metal portion [20] defining an internal volume,” “a transmitter/receiver circuit [69], located within the housing, including a ground reference connected to the metal portion [20] of the housing,” “a tissue stimulation circuit [69] located within the housing.” [Spec. at pars. 0037, 0038 and 0042.] The illustrated example of the claimed device also includes “an elongate antenna [60] with at least one folded portion operably connected to the transmitter/receiver circuit [69] and positioned within the dielectric portion [30] such that transmissions from the at least one folded portion are receivable outside the dielectric portion.” [Spec. at pars. 0038, 0041 and 0042.]

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**A. Rejections Under 35 U.S.C. § 103**

Claims 1-12, 22-28, 30 and 32-38 have been rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,240,317 to Villaseca (“the Villaseca patent”). On pages 2-6, the Office Action stated:

Regarding Claims 1-3,5,13-15,22,25-28 and 30-38, Villaseca et al. shows in Fig. 7, for example, an RF telemetry antenna system for communication between an external programmer and an implantable medical device, where the system comprises an implantable medical device 122 having a housing made of metal such as titanium and of a cylindrical form and defining an internal volume, and a dielectric housing portion 138 defining an internal volume, a self-resonating, monopole antenna 124, wire 134, 136 with free end and connection end 126 contained within the internal volume defined by the dielectric portion 138, an internal TX/RX (col. 9, lines 15-26) operating in the 400 MHz. band and comprising a tissue stimulation circuit, where the antenna has an elongate form, folded at least once and conforms with the inside of the housing 138, and the connection end 126 has the shield 124 of

the antenna connected to the conductive housing 122 defining a ground reference forming a ground plane as claimed. Therefore, the skilled artisan would have found it obvious that the internal transceiver circuit is grounded to the housing, at least through the shield of the coax. However, a ground internal the housing, connected to the transceiver would have been obvious to the skilled artisan, in order to eliminate any ground loops and spurious radiation inherent in circuits.

Regarding Claims 2, 3 and 14, the transceiver is formed on a p.c. board and the housing 138 is epoxy/plastic and the housing 122 is titanium.

Further regarding Claims 22 and 24, the particular geometry of an antenna and any change therein, is obvious to the skilled artisan. Thus, the skilled artisan would have found it obvious to employ the center conductor of the antenna that extends along the side of the housing back toward the feed point. Such an arrangement is dependent upon the radiation beam pattern desired, the impedance match and other radiation/antenna characteristics, particularly since no unexpected results are evident in the claims.

Regarding Claims 4, 6-8 and 16-18, the permittivity value of 3.6 for the housing, specific wire composition, size and gauge thereof, are all obvious to the skilled artisan to achieve when selecting stock shelf materials in a particular design application used in the implantable device.

Regarding Claims 9, 10, 19, 20, 22 and 24, the shield 124 is disposed in an arc and the center conductor 134 is in a parallel arc, folded to provide maximum separation between housing and antenna.

Regarding claims 11 and 21, the frequency of operation is strictly an FCC-mandated allocation, made obvious by the skilled artisan using antenna frequency scaling.

Regarding Claims 12 and 23, shaping of the housing is always considered obvious to the skilled artisan to fit a particular environment, absent any unexpected results.

* * * * *

[T]he geometry of the antenna radiator, as in the reference to Villaseca, is always a matter of design choice and obvious and known that the folded antenna effects impedance and the radiation pattern, absent any unexpected results.

The issue of the ground reference involves a mere connection of the ground of the circuit connected to the conductive housing. At least the shield of the coax is connected to the housing, providing a positive ground connection to the circuitry. Since evidence of obviousness is shown in the reference, the rejections stand.

Claim 29 has been rejected under 35 U.S.C. § 103 as being unpatentable over the combined teachings of the Villaseca patent and U.S. Patent No. 6,456,256 to Amundson ("the Amundson patent"). On page 4, the Office Action stated:

[N]o specific teaching of "a spinal cord stimulation circuit" appears to be suggested in Villaseca et al. However, such a circuit within the housing falls under the class of implantable medical devices, taught by Villaseca et al. Amundson et al. teach that the implantable device disclosed thereby utilizes a curved/arcuate, monopole antenna with the housing used as a ground plane, where the antenna is connected to circuitry within the shielded housing for neuromuscular stimulation. Spinal cord stimulation falls under such use. Thus, it would have been obvious to the skilled artisan to include such circuitry in the housing of Villaseca et al.

VII. ARGUMENTS

A. The Legal Standards For a Rejection Under 35 U.S.C. § 103

With respect to the legal standards upon which patentability under 35 U.S.C. § 103 is evaluated, *In re Kotzab*, 55 USPQ2d 1313, 1316-17 (Fed. Cir. 2000), provides a fairly succinct summary of the standard adhered to by the Federal Circuit:

A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." Most if not all inventions arise from a combination of old elements. Thus, every element of a claimed invention may often be found in the prior art. However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant. ***Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference.***

[Citations emitted, emphasis added.] The *Kotzab* decision is also cited in Section 2143.01 of the Manual of Patent Examining Procedure ("MPEP").

"The motivation, suggestion or teaching may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some case, the nature of the problem to be solved. In addition, the teaching, suggestion or motivation may be implicit from the prior art as a whole, rather than expressly stated." *In re Kotzab*, 55 USPQ2d at 1317. Whether the showing is explicit or implicit, "rejections on obviousness grounds **cannot be sustained by mere conclusory statements**; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006), *citations omitted, emphasis added*. To that end, "particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected [the] components for combination in the manner claimed." *In re Kotzab*, 55 USPQ2d at 1317. "This factual question of motivation is material to patentability, and **[may] not be resolved on subjective belief and unknown authority**." *In re Lee*, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002), *emphasis added*.

B. The Cited References

The Villaseca patent discloses a number of implantable medical devices. The device illustrated in Figure 7, which is reproduced below, includes an enclosure 122 and an antenna that is molded into an L-shaped plastic connector block 138. The antenna includes a central conductor 134 and a braided shield 124 that covers a portion of the central conductor 134 and is electrically coupled to the enclosure 122. The central conductor 134 is coupled to a feedthrough 126 which is, in turn, coupled to the transceiver within the enclosure 122.

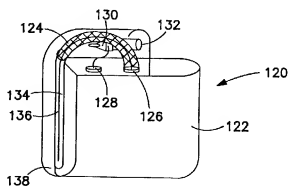


FIG. 7

The Amundson patent is directed to an implantable medical device with a circumferential antenna.

C. Arguments Concerning Claims 1-12 and 30

Independent claim 1 calls for a combination of elements including, *inter alia*, “an internal transmitter/receiver circuit having a **ground reference located within the metal housing portion that is connected to the metal housing portion** such that the metal housing portion acts as a ground plane.” The respective combinations defined by claims 2-12 and 30 include, *inter alia*, the elements recited in claim 1.

The Villaseca patent, which is the basis for the single-reference Section 103 rejection at issue, fails to teach or suggest the claimed combinations. For example, even assuming for the sake of argument that the enclosure 122 corresponds to the claimed “metal housing portion,” there is nothing in the Villaseca patent which suggests that there is a ground reference within the enclosure 122 that is connected to the enclosure 122. Faced with this clear shortcoming in the Villaseca patent, the Office Action stated that:

the connection end 126 has the shield 124 of the antenna connected to the conductive housing 122 defining a ground reference forming a ground plane as claimed. Therefore, the skilled artisan would have found it obvious that the internal transceiver circuit is grounded to the housing, at least through the shield of the coax. However, a ground internal the housing, connected to the transceiver would have been obvious to the skilled artisan, in order to eliminate any ground loops and spurious radiation inherent in circuits.

[Office Action at pages 2 and 3.] The Office Action is, however, devoid of any support whatsoever for the assertion that, absent applicant’s disclosure, one of skill in the art would have been motivated to “eliminate any ground loops and spurious radiation” by connecting an internal ground to the housing of Villaseca’s implantable medical device. As such, the Office Action has impermissibly based a Section 103 rejection on nothing more than “mere conclusory statements,” “subjective belief and unknown authority.” See *In re Kahn* and *In re Lee, supra*.

As the Office Action failed to establish a *prima facie* case of obviousness with respect to independent claim 1, applicant respectfully submits that the rejection of claims 1-12 and 30 under 35 U.S.C. § 103 is improper and should be reversed.

D. Arguments Concerning Claims 22, 23, 25-29 and 32

Independent claim 22 calls for a combination of elements including, *inter alia*, "a housing having a dielectric portion defining an internal volume and a metal portion defining an internal volume," "a transmitter/receiver circuit located within the housing" and "***an elongate monopole RF antenna, with a connection end, a free end and at least one fold between the connection end and the free end, operably connected to the transmitter/receiver circuit and positioned entirely within the dielectric portion internal volume such that the free end is closer to the connection end than the at least one fold.***" The combinations defined by claims 23, 25-29 and 32 include, *inter alia*, the elements recited in claim 22.

The Villaseca patent, which is the basis for the single-reference Section 103 rejection at issue, fails to teach or suggest the claimed combinations. For example, and as noted in the Office Action, the Villaseca antenna is not folded and positioned within the plastic connector block 138 with the free end closer to the connection end than the fold. Faced with this clear shortcoming in the Villaseca patent, the Office Action stated that "the particular geometry of an antenna and any change therein, is obvious to the skilled artisan" and that the claimed configuration is "dependant upon the radiation beam pattern desired, the impedance match and other radiation/antenna characteristics." [Office Action at page 3.]

The Office Action did not, however, provide so much as scintilla of evidence to support these statements. For example, the Office Action did not provide any evidence that, in the context of implantable medical devices, every possible antenna shape is a *prima facie* obvious variation of existing shapes. Nor did the Office Action explain why, in the context of the Villaseca implantable medical device, certain radiation beam patterns, impedances and other radiation/antenna characteristics known only to the Examiner would

have led one of skill in the art to the particular configuration recited in claim 22. Accordingly, applicant respectfully submits that the Office Action impermissibly relied on “mere conclusory statements,” “subjective belief and unknown authority” to arrive at an obviousness determination. See *In re Kahn* and *In re Lee*, *supra*.

As the Office Action failed to establish a *prima facie* case of obviousness with respect to independent claim 22, applicant respectfully submits that the rejection of claims 22, 23, 25-28 and 32 under 35 U.S.C. § 103 is improper and should be reversed.

It is also noteworthy that the Office Action appears to based its conclusion of obviousness at least in part on a purported lack of unexpected results. Given the failure of the Office Action to establish a *prima facie* case of obviousness, the issue of “unexpected results” is premature.

With respect to claim 29, applicant respectfully submits that the Amundson patent fails to remedy the aforementioned deficiencies in the Villaseca patent and that claim 29 is patentable for at least the same reasons as independent claim 22. The rejection of claim 29 under 35 U.S.C. § 103 should, therefore, also be reversed.

E. Arguments Concerning Claim 24

Independent claim 24 calls for a combination of elements including, *inter alia*, “a housing having a dielectric portion, defining an internal volume and including a curved region, and a metal portion defining an internal volume,” “a transmitter/receiver circuit located within the housing” and “an elongate monopole RF antenna, with **at least one fold and first and second arcuate portions** that extend along the curved region **in first and second planes that are substantially parallel to one another**, operably connected to the transmitter/receiver circuit and positioned entirely within the dielectric portion internal volume.”

The Villaseca patent, which is the basis for the single-reference Section 103 rejection at issue, fails to teach or suggest the claimed combination. For example, Office Action has apparently taken the position that the Villaseca shield 124 and center conductor 134 correspond to the claimed “first and second arcuate portions” and that shield 124 and

center conductor 134 are “in first and second planes that substantially parallel to one another.” [Office Action at page 3.] As illustrated in Figure 7, which is reproduced below, the Villaseca center conductor 134 is located **within**, and is **coaxial with**, the shield 124. Thus, the Office Action has taken the position that when a first object is located within and is coaxial with a second object, the first and second object

can also be in two different parallel planes. Applicant respectfully submits that such an interpretation of the claim is well beyond the broadest reasonable interpretation.¹ Figures 1-5 and paragraph 0038 of the present application clearly illustrate and describe an antenna with separate arcuate portions that are in planes that are substantially parallel to one another is not what is shown in Figure 7 of the Villaseca patent.

[A portion of Figure 5 of the present application is reproduced here.] The present application notwithstanding, the Office Action has essentially taken the position that any linear or curvilinear object that is not perfectly two-dimensional (i.e. has a thickness dimension) will have two arcuate

portions in two parallel planes merely because it has a third (i.e. thickness) dimension. Based on the interpretation proposed in the Office Action, a human hair in the shape of the Villaseca antenna would have two curved portions in two different parallel planes by virtue of the fact that a hair has some minute thickness and is not perfectly flat. Applicant respectfully submits that such an interpretation cannot sustain a rejection under 35 U.S.C. § 102 or 103.

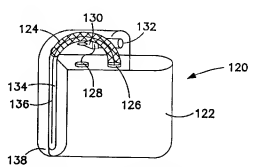
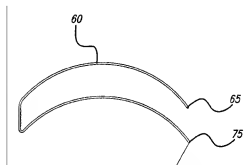


Figure 7 of the Villaseca Patent



Portion of Figure 5 of the Present Application

¹ As discussed in *In re Cortright*, 49 USPQ2d 1464, 1467 (Fed. Cir. 1999), claims in an application are to be given their broadest reasonable interpretation. This interpretation must be “consistent with the specification” and “consistent with the one that those skilled in the art would reach.” *Id.*

The Office Action also fail to provide any evidence as to why one of ordinary skill in the art would have been motivated to modify the Villaseca antenna in such a manner that it assumed the claimed shape.

As the Office Action failed to establish a *prima facie* case of obviousness with respect to independent claim 24, applicant respectfully submits that the rejection of claim 24 under 35 U.S.C. § 103 is improper and should be reversed.

F. Arguments Concerning Claims 33-38

Independent claim 33 calls for a combination of elements including, *inter alia*, “a housing having a dielectric portion defining an internal volume and a metal portion defining an internal volume,” “a transmitter/receiver circuit, located within the housing, including a ***ground reference connected to the metal portion of the housing***,” “a tissue stimulation circuit located within the housing” and “an ***elongate antenna with at least one folded portion*** operably connected to the transmitter/receiver circuit and positioned within the dielectric portion such that ***transmissions from the at least one folded portion are receivable outside the dielectric portion***.” The respective combinations defined by claims 34-38 include, *inter alia*, the elements recited in claim 33.

The Villaseca patent, which is the basis for the single-reference Section 103 rejection at issue, fails to teach or suggest the claimed combinations. For example, even assuming for the sake of argument that the enclosure 122 corresponds to the claimed “metal housing portion,” there is nothing in the Villaseca patent which suggests that there is a ground reference within the enclosure 122 that is connected to the enclosure 122. Faced with this clear shortcoming in the Villaseca patent, the Office Action stated that:

the connection end 126 has the shield 124 of the antenna connected to the conductive housing 122 defining a ground reference forming a ground plane as claimed. Therefore, the skilled artisan would have found it obvious that the internal transceiver circuit is grounded to the housing, at least through the shield of the coax. However, a ground internal the housing, connected to the transceiver would have been obvious to the skilled artisan, in order to eliminate any ground loops and spurious radiation inherent in circuits.

[Office Action at pages 2 and 3.] The Office Action is, however, devoid of any support whatsoever for the assertion that, absent applicant's disclosure, one of skill in the art would have been motivated to "eliminate any ground loops and spurious radiation" by connecting an internal ground to the housing of Villaseca's implantable medical device. As such, the Office Action has impermissibly based a Section 103 rejection on nothing more than "mere conclusory statements," "subjective belief and unknown authority." See *In re Kahn* and *In re Lee*, *supra*.

The Office Action also failed to explain how transmissions from the Villaseca "folded portion," i.e. the portion of the antenna that includes the **braided shield** 124, are receivable outside the L-shaped plastic connector block 138. One of skill in the art would understand that the purpose of the braided shield 124 is to **prevent** electromagnetic energy from the central conductor 134 from escaping from the portion of the antenna that includes the braided shield 124.

As the Office Action failed to establish a *prima facie* case of obviousness with respect to independent claim 33, applicant respectfully submits that the rejection of claims 33-38 under 35 U.S.C. § 103 is improper and should be reversed.

It is also noteworthy that the Office Action appears to based its conclusion of obviousness at least in part on a purported lack of unexpected results. Given the failure of the Office Action to establish a *prima facie* case of obviousness, the issue of "unexpected results" is premature.

VIII. CLOSING REMARKS

As applicant has shown above, the rejection of claims 1-12, 22-30 and 32-38 under 35 U.S.C. § 103 is improper and should be reversed.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0638. Should such

fees be associated with an extension of time, applicant respectfully requests that this paper be considered a petition therefor.

Respectfully submitted,

July 20, 2006

Date

/Craig A. Slavin/

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CLAIMS APPENDIX

1. An RF telemetry antenna system for communications between an external programmer and an implantable medical device, said system comprising:

an implantable medical device housing including a conductive, metal housing portion defining an internal volume and a dielectric housing portion defining an internal volume;

a self-resonating, monopole RF antenna contained within the internal volume defined by said dielectric portion of said medical device housing, said monopole antenna having a free end and connection end; and

an internal transmitter/receiver circuit having a ground reference located within the metal housing portion that is connected to the metal housing portion such that the metal housing portion acts as a ground plane;

wherein the monopole RF antenna has an elongate form which is folded at least once and conformed inside the internal volume defined by the dielectric housing portion, and

wherein the connection end of the antenna is connected to the internal transmitter/receiver circuit.

2. The system of claim 1, wherein the monopole RF antenna is coupled to the transmitter/receiver circuit that is placed on an internal, printed circuit board.

3. The system of claim 1, wherein the dielectric housing portion is a biocompatible epoxy and the metal housing portion is titanium.

4. The system of claim 3, wherein the epoxy has a dielectric constant ϵ_r of about 3.6.

5. The system of claim 1, wherein the antenna elongate form is a conductive wire.

6. The system of claim 1, wherein the antenna is made from a conductive material from the group consisting of copper, platinum and gold.

7. The system of claim 6, wherein the antenna is formed from copper wire that is 20 AWG.

8. The system of claim 1, wherein the antenna elongate form is a conductive strip.

9. The system of claim 1, wherein the RF monopole antenna is folded within the dielectric housing portion to provide maximum separation between the folded monopole antenna and the metal housing portion.

10. The system of claim 9, wherein the folded monopole antenna is formed into a shape comprising a first arc and second arc,
wherein the first arc is in a first plane and the second arc is in a second plane, which planes are substantially parallel to each other.

11. The system of claim 1, wherein the RF monopole antenna is sized to provide an antenna self-resonance frequency of about 403.5 MHz.

12. The system of claim 1, wherein the dielectric housing portion is a portion of a substantially flat, elliptical cylinder.

22. An implantable medical device, comprising:
a housing having a dielectric portion defining an internal volume and a metal portion defining an internal volume;
a transmitter/receiver circuit located within the housing; and
an elongate monopole RF antenna, with a connection end, a free end and at least one fold between the connection end and the free end, operably connected to the transmitter/receiver circuit and positioned entirely within the dielectric portion internal volume such that the free end is closer to the connection end than the at least one fold.

23. An implantable medical device as claimed in claim 22, wherein the dielectric portion of the housing includes a curved region and the antenna includes first and second arcuate portions that extend along the curved region.

24. An implantable medical device, comprising:
a housing having a dielectric portion, defining an internal volume and including a curved region, and a metal portion defining an internal volume;
a transmitter/receiver circuit located within the housing; and
an elongate monopole RF antenna, with at least one fold and first and second arcuate portions that extend along the curved region in first and second planes that are substantially parallel to one another, operably connected to the transmitter/receiver circuit and positioned entirely within the dielectric portion internal volume.

25. An implantable medical device as claimed in claim 22, wherein the transmitter/receiver circuit is connected to the metal portion of the housing.

26. An implantable medical device as claimed in claim 25, wherein the transmitter/receiver circuit includes a ground reference and the ground reference is connected to the metal portion of the housing.

27. An implantable medical device as claimed in claim 22, wherein the antenna comprises one of an elongate conductive wire and an elongate conductive strip.

28. An implantable medical device as claimed in claim 22, wherein the housing defines a substantially cylindrical shape having a central axis and the dielectric portion and the metal portion are separated by a plane that is parallel to the central axis.

29. An implantable medical device as claimed in claim 22, further comprising:
a spinal cord stimulation circuit within the housing.

30. The system of claim 1, wherein the monopole RF antenna is embedded in the dielectric housing portion.

32. An implantable medical device as claimed in claim 22, wherein the elongate monopole RF antenna is embedded in the dielectric portion of the housing.

33. An implantable medical device, comprising:
a housing having a dielectric portion defining an internal volume and a metal portion defining an internal volume;
a transmitter/receiver circuit, located within the housing, including a ground reference connected to the metal portion of the housing;
a tissue stimulation circuit located within the housing; and
an elongate antenna with at least one folded portion operably connected to the transmitter/receiver circuit and positioned within the dielectric portion such that transmissions from the at least one folded portion are receivable outside the dielectric portion.

34. An implantable medical device as claimed in claim 33, wherein the dielectric portion of the housing includes a curved region and the antenna includes first and second arcuate portions that extend along the curved region.

35. An implantable medical device as claimed in claim 33, wherein the antenna comprises a monopole RF antenna.

36. An implantable medical device as claimed in claim 33, wherein the antenna comprises one of an elongate conductive wire and an elongate conductive strip.

37. An implantable medical device as claimed in claim 33, further comprising:
at least one lead connector associated with the dielectric portion and operably connected to the tissue stimulation circuit.

38. An implantable medical device as claimed in claim 33, wherein the antenna is embedded in the dielectric portion of the housing.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.